

# LAWS AND POLICIES ON BIOTECHNOLOGY AND FORENSIC SCIENCE UNDER THE NIGERIAN AND UNITED STATES CRIMINAL JUSTICE ADMINISTRATION

**Omoshola Abiodun AKINGBOYE <sup>a</sup>**

**Itunu KOLADE-FASEYI, PhD <sup>b</sup>**

&

**Akintunde ADEBAYO, PhD<sup>c</sup>**

## **Abstract**

The relationship between law, science, and the society are indivisible. Like the essence of the law is to regulate the society, the essence of science is to improve the society's standard of living through its many innovations. The integration of modern scientific techniques into law enforcement practices have become very crucial in criminal investigation and prosecution in order to secure the truth in criminal responsibility and rule out miscarriage of justice. This paper examines the legal framework regulating biotechnology and forensic science in Nigeria and the United States of America. It evaluates the extent to which both jurisdictions have adapted their legal systems to accommodate the evolving innovations of biotechnology and forensic science innovation in criminal justice administration while safeguarding constitutional rights and ethical standards. The paper adopts a doctrinal and analytical approach in evaluating the effectiveness and limitations of available framework in both jurisdictions while drawing learning points for Nigeria. The paper finds out that there exists sharp contrast in forensic administration between the two jurisdictions studied. In conclusion, the paper recommends interventions like law reform and establishment of autonomous agency, training of forensic experts and establishment of central criminal database to harness the full potential of biotechnology and forensic science in Nigeria criminal justice system.

**Keywords:** Biotechnology, Criminal Investigation, Criminal Justice System, Forensic Biotechnology, Forensic Science.

## **1. Introduction**

The central essence of the criminal justice system is to investigate crime and punish offenders found guilty.<sup>1</sup> The end result of criminal investigation not thoroughly conducted is that an innocent

---

<sup>a</sup> Lecturer, Department of Private Law, College of Law, Caleb University, Lagos Nigeria. [omosholaakingboye@gmail.com](mailto:omosholaakingboye@gmail.com) Mobile No. 08032415882.

<sup>b</sup> Lecturer, Department of Public Law, College of Law, Caleb University, Lagos Nigeria. [itmowo@gmail.com](mailto:itmowo@gmail.com)

accused may be punished for crime he did not commit, the real culprit will evade punishment for his crimes and justice generally will be delayed and denied.<sup>2</sup> The Criminal investigation process which starts with inquiry into criminal allegations and the collection of evidence has become more elaborate with the complexity in human relation. The manner in which crimes are being committed- with the aid of sophisticated technologies that would in essence require scientific methods to decipher the truth in identifying who the real criminal is further underscores these complexities. Forensic scientific methodology in criminal investigation has been an adequate tool in solving millions of crimes in developed countries like the United States of America and the United Kingdom, it is reported to be a reliable approach in criminal investigation.<sup>3</sup>

Scientific knowledge is meaningless unless it is geared towards practical application in human affairs.<sup>4</sup> The scientific approach in solving human problem involves the application of scientific methods where through observations problems are identified and stated, and hypothesis are formulated. Experiments are designed to test the validity of such hypothesis and test are conducted to solve the identified problems. Possible outcomes are observed and data from experiment conducted are collected. The whole process comes to an end when the researcher shares his research findings/ outcome and make appropriate recommendations. The products of the various scientific methods carried out are scientific hypotheses, theories, principles and laws.<sup>5</sup>

Forensic science being a subdivision of scientific knowledge primarily covers the acquisition, study and interpretation of evidence for the purpose of shedding light into a legal inquiry. Such

---

<sup>c</sup> Legal Practitioner and formerly Sub-Dean, Faculty of Law, Adekunle Ajasin University, Akungba-Akoko, Nigeria. [akintunde\\_adebayo@yahoo.co.uk](mailto:akintunde_adebayo@yahoo.co.uk)

<sup>1</sup> A. Akinade and T.O Onuminya, *Forensic Science, Criminal Investigations and Justice Administration: Need for Reform*, Proceedings of the 12th International Security Conference., 4.

<sup>2</sup> *Ibid*, 4.

<sup>3</sup> See S. A Bradbury, and A. Feist, 'The Use of Forensic Science in Volume Crime Investigations: A Review of the Research Literature', 75. <https://assets.publishing.service.gov.uk/media/5a7ad567e5274a34770e76f6/hoor4305.pdf> ; and

Committee on Identifying the Needs of the Forensic Sciences Community, National Research Council. *Strengthening Forensic Science in the United States: A Path Forward*, 269. <http://www.nap.edu/catalog/12589.html> (accessed 6 March, 2025).

<sup>4</sup> A. O. Anya, (2001). 'Science Development and the Future: The Nigerian Case' in *Reflections and Essays on the Nigerian Socio-Cultural Experience* (University of Nigeria Press, Enugu 1982). 74.

<sup>5</sup> W. I. B Beveridge. *The Art of Scientific Investigation*. (Heinemann., London. 1990).

inquiry usually relates to solving a crime or clarifying a legal subject.<sup>6</sup> Forensic science extends to a broad range of sub-sciences which utilizes natural science technique to obtain relevant criminal and legal evidence. Biotechnology though not a direct subdivision of forensic science has become integrated with forensic science, primarily to identify persons involved in the criminal episode. Perpetrators or victims of a crime and other possible players present at the crime scene can be identified through their body fluids or body materials found at the crime scene.

The need for reliable and functional regulation of forensic activities cannot be overemphasized. The importance of having clear and adequate laws and policies regulating forensic science is to dictate qualitative standards of operations, acceptable mandates and parameters for standardized forensic practice, and the need for authentic and reliable admissible evidence to achieve a dependable and trustworthy criminal justice system. Where this is in place, individual and national security is not far-fetched. This paper seeks to comparatively examine the laws and policies in operation in Nigeria and the United States of America, with a view of learning from the latter's criminal administration which is obviously more advanced than that of Nigeria.

## 2. Conceptual Clarification

The term 'forensic' is a derivative from the latin word '*forensis*' which means 'in open court,' 'in a forum' or 'in public.' The term forensic originates from Roman times, when a criminal charge meant presenting the case before a group of public individuals in the forum.<sup>7</sup> In ancient Rome, a person alleged to have committed a crime is tried and defended in public where a case is presented for trial.<sup>8</sup> This origin is the source of the two modern usages of the word forensic—as a form of legal evidence and as a category of public presentation.<sup>9</sup> The word 'science' is derived from the Latin word '*scientia*' (knowledge). It can be described as the organized or systematic way of

---

<sup>6</sup> J. Nickell and J. F. Fischer. *Crime Science: Methods of Forensic Detection*. (University Press of Kentucky, 1999) 285.

<sup>7</sup> Forensic Science and Law <https://www.lawyersnjurists.com/article/forensic-science-and-law/> (accessed 5 March 2025).

<sup>8</sup> C. H. Pinke Rodrigues, and 6 others, Forensic Science or Forensic Sciences? Conceptual Analysis (2022) (11) (12) *Research, Society and Development*.

<sup>9</sup> <https://www.study.com/learn/lesson/what-is-forensic-science-forensic-science-types-etymology.html>

acquiring knowledge. Many dictionaries define the term ‘forensic’ both as ‘the application of scientific knowledge to legal problems’ and as a synonym for ‘legal’, ‘judicial’ or ‘pertaining to court of law.’<sup>10</sup> This reveals its close association with the criminal scientific methodologies to obtain relevant criminal and legal evidence. Consequently, the word forensic science would mean the use of scientific methods and processes for solving crime. It has been defined as ‘the application of science in criminal justice to the public and criminal law enforcement by law enforcement.’<sup>11</sup> In relation to criminal law, forensic application includes the analysis of crime and criminal behavior all with the aim of uncovering the truth of what transpired at a crime scene and determining criminal responsibility.

Forensics aims at using scientific techniques and tools to interpret criminal evidence. For example, forensics uses physics to analyze blood structure; biology to determine the origin of unknown persons, and chemistry to clarify chemical composition.<sup>12</sup> In criminal investigation, forensics is used to determine fingerprints, DNA, bloodstain patterns, firearms, ballistics, toxicology, microscopy and fire debris analysis.<sup>13</sup> Forensic analysis will include matching fingerprints found on a gun to a particular suspect's, or analyzing microscopic marks on a bullet to determine whether a particular bullet was fired from a particular gun. DNA profiling of a deceased for identification, determining if a genetic match exist though the use of blood, saliva, semen or other appropriate fluid or tissue from personal items such as hair all falls within the purview of forensic analysis. Generally, the goal of forensic science is in uncovering the truth and not in proving guilt or innocence.

---

<sup>10</sup> Black Law Dictionary, 2<sup>nd</sup> ed- <https://www.thelawdictionary.org/forensic/>; Merriam-Webster [www.merriam-webster.com/dictionary](http://www.merriam-webster.com/dictionary), Cambridge Dictionary <https://www.dictionary.cambridge.org/dictionary> (accessed 5 March 2025).

<sup>11</sup> N. K Gupta, S. Bhadauria, Role of Forensic Science in Criminal Investigation, (2024) (6) (2) *International Journal for Multidisciplinary Research*.

<sup>12</sup> N.K Gupta, and S. Bhadauria, *ibid*.

<sup>13</sup>Bureau of Justice Statistics. *Forensic Sciences* <https://bjs.ojp.gov/topics/forensic-sciences> (accessed 19 February, 2025).

Biotechnology has been described as the use of biology to develop new products, methods and organisms intended to improve human health and society.<sup>14</sup> Methods employed are technologically based on biology which ‘harnesses cellular and bio molecular processes to develop technologies and products that help improve our lives and the health of our planet’,<sup>15</sup> According to Norwegian University of Technology, biotechnology is ‘the technology that utilizes biological systems, living organisms or parts of it to develop or create different products.’<sup>16</sup> Biotechnology has been prominent in the production of drugs, vaccines, alcohol, beverages, preservation of diary products etc. Modern biotechnology applications expanded its scope into genetic engineering, or recombinant DNA technology. Genetic engineering involves modification, transplanted or recombination of DNA or genetic cell structures in order to modify an organism or its population.<sup>17</sup> This technique has led to certain medical products such as human insulin, human growth hormone, hepatitis B vaccine as well as the development of genetically modified organisms such as disease-resistant plant.<sup>18</sup> It has also invented improved intervention techniques such as artificial insemination, in vitro fertilization (IVF), cloning and gene manipulation<sup>19</sup> By modifying or interacting with genes, scientists can strengthen the characteristics of an organism or create an entirely new organism.<sup>20</sup>

The point of intersection of forensic science and biotechnology is the DNA analysis technique which is a most significant aspect of biotechnology.<sup>21</sup> Since it was first introduced in the mid-1980s, DNA analysis, also called DNA fingerprinting, DNA typing or DNA profiling has revolutionized forensic science, especially in the area of identification of individual in forensic investigation of serious crimes such as homicide, rape, and assault.<sup>22</sup> The result of the application

---

<sup>14</sup> N. Barney and S. Lewis. *What is Biotechnology? Definition, Types and Application*; <https://www.techtarget.com> (accessed 10 February, 2025)

<sup>15</sup> A.I. Imosemi, ‘Criminal, Civil and Ethical Framework for Advancements of Benefits of Biotechnology to Mankind’ (2019) (22) (3) *African Journal of Biomedical Research*. 221- 227.

<sup>16</sup> *Ibid.*

<sup>17</sup> Britannica. *Genetic Engineering*. <https://britannica.com> (accessed 10 February, 2025).

<sup>18</sup> *Ibid.*

<sup>19</sup> *Ibid.*

<sup>20</sup> N Barney, *opcit.*

<sup>21</sup> V. V. Pillay, and 9 others. ‘Biotechnology in Forensic Science: The Revolution Continues’ (2007) 9 (1) *Nepal Medical College Journal*, 1.

<sup>22</sup> *Ibid.*

of biotechnological techniques in forensic investigation has become a novel branch of forensic science referred to as ‘forensic biotechnology.’<sup>23</sup>

### **3 Theoretical Framework on Forensic Biotechnology**

Forensic biotechnology can be explained from different perspectives-law, criminology, forensic psychology, sociology, among others. Several explanations have been put forward to explain why individuals engage in criminal activities and the role of forensic science in the criminal justice system as far as criminal profiling, crime prevention, crime detection and punishment of offenders are concerned. An understanding of these theories will help in developing effective responses to crime and criminalities. Some of the relevant theories are discussed below:

#### **3.1 Trace Evidence Theory**

The Trace Evidence Theory is a foundational principle in forensic science based on the Locard’s Exchange Principle which explains that every contact leaves a trace.<sup>24</sup> A perpetrator of crime brings something to the crime scene and leaves with something which can be hair, blood, finger prints, skin cells, fibre, chemical residue among others.<sup>25</sup> It is important to state that trace evidence are usually analyzed in forensic laboratories with the aid of sophisticated instruments and techniques. Where evidence is not properly stored, its contamination, may affect its integrity and admissibility in court.<sup>26</sup>

#### **3.2 Genetic Similarity Theory**

---

<sup>23</sup> F. Althobaitl, A. Lafi, and T. Alanizi, ‘Biotechnological Applications in Forensic: Questioning the Effect of Sunlight Conditions on DNA Integrity Extracted from Blood and Hair Samples’ (2024) (31) (2) *Journal of Population Therapeutics & Clinical Pharmacology*.

<sup>24</sup> D. Mummery, ‘Every Contact Leaves a Trace’ (2021) 71(712) *British Journal of General Practice*, 512.

<sup>25</sup> L. Ware, *Crime Scene Processing and Recovery of Physical Evidence from Sexual Assault Scenes* [https://evawintl.org/wp-content/uploads/Module-12\\_Crime-Scene-Processing.pdf](https://evawintl.org/wp-content/uploads/Module-12_Crime-Scene-Processing.pdf) (accessed 19 February 2025).

<sup>26</sup> I. O Olude, ‘Human Rights Perspective on the Acquisition and Use of Trace Evidence in Forensic Investigation in Nigeria’ (2024) (9) *African Journal of Criminal Law and Jurisprudence*, 165.

This theory in explaining the uniqueness of individuals holds that every individual is unique. There are features peculiar to people which they do not share with others, no two individuals are exactly the same. With the genetic similarity theory, it is easy to link a crime to a particular suspect because his or her unique feature fits that of the perpetrator.<sup>27</sup>

### **3.3 Forensic Toxicology Theory:**

This theory explains how biological samples are analyzed to determine toxins in biological fluids or tissues and how these toxins have interacted with the individual's system. It can be adopted to know the cause of a death or the factors responsible for human performance.<sup>28</sup>

### **3.4 Crime Opportunity Theory:**

The Crime opportunity theorists posit that crime happens when an individual is motivated to commit crime and opportunity favourable to committing such crime is presented.<sup>29</sup> To the theorists, when these opportunities are taken away, then crime will be less attractive for such individuals and to a large extent the level of criminality will reduce. These opportunities can be taken away or reduced when crimes are made difficult to accomplish or cover up. The use of advanced security system or surveillance to a large extent can reduce the predisposition to crime. The theory is straightforward as it seeks to minimize opportunities and deter crime commission.

One of the criticisms of this theory is the fact it does not take a holistic approach to criminality. It is not in all cases that 'opportunities' in the environment give room for crime. Some psychological causes and social issues like poverty, inequality or lack of education can influence criminal

---

<sup>27</sup> J. Koehler and M.J. Saks, 'Individualization Claims in Forensic Science: Still Unwarranted' (2010) (75) (4) *Brooklyn Law Review*, 1187–1208.

<sup>28</sup> R. Wennig. *Forensic Toxicology Encyclopedia of Life Support System*  
[https://www.eolss.net/ebooklib/sc\\_cart.aspx?File=E6-12-23-00](https://www.eolss.net/ebooklib/sc_cart.aspx?File=E6-12-23-00) (accessed 2 March 2025).

<sup>29</sup> National Institute of Justice, <https://nij.ojp.gov/nj-josted-online-training-courses/> (accessed 16 February 2025).

<sup>29</sup> *Ibid.*

tendencies.<sup>30</sup> Also, when these opportunities are blocked, it is likely offenders would move on to other crimes which are less traceable and do not require so much sophistication to accomplish.

### **3.5 Routine Activities Theory:**

The theoretical conceptualization of forensic biotechnology using the routine activities theory can help to understand forensics and crime. This theory explains how patterns of people's daily tasks or activities can create opportunities for criminal offending. Crime is likely to occur where there is a motivated offender, a suitable target and absence of capable guardianship. Availability of these factors creates a perfect opportunity for the crime to be carried out.<sup>31</sup> Inadequate or non-existing legal or technological protection to deter the offender and to safeguard the target invariably leads to untoward consequences.

From the discussions above, it is clear that forensic biotechnology cannot be grounded on a single theory. The diverse theoretical explanations underscore the futility of conceptualizing and explaining it from a standpoint. It is important to note that there is no perfect theory; none is entirely right or wrong. One thing common to the theories however is that since consequences of criminal acts may be monumental, what physical investigation cannot reveal can easily be brought to light with the adoption of forensic technology.

## **4 Forensic Biotechnology in Criminal Investigation**

Forensic science is known for its many sub-divisions which all work together in different respect in criminal investigation. They constitute a wide range of activities which include forensic

---

<sup>30</sup> <https://docmckee.com/cj/docs-criminal-justice-glossary/opportunity-theory-definition/> (accessed 4 February, 2025).

<sup>31</sup>E.E. Mustaine, and R. Tewksbury, 'A Routine Activity Theory Explanation for Women's Stalking Victimization' (1999) (5) (1) *Violence against Women*, 46-47.

medicine,<sup>32</sup> odontology,<sup>33</sup> anthropology,<sup>34</sup> psychiatry, toxicology,<sup>35</sup> botany, entomology questioned documents examination,<sup>36</sup> firearm and tool mark,<sup>37</sup> fingerprint examinations, as well as DNA fingerprinting criminalistics.<sup>38</sup> Forensic biotechnology, considered as one of the subdivision deals with identifying DNA obtained from a variety of biological sample such as hair, blood or biological fluids samples found at a crime scene, linking a suspect to a crime or in identifying victims of a crime.<sup>39</sup>

The forensic science's technique in criminal investigation begins with identifying and collecting physical evidence found at the crime scene including fingerprints, blood, hair, clothing, weapons and more. Forensic experts reconstruct the pattern of events that led to the crime, taking into account the environment and patterns of evidence.<sup>40</sup> Upon the commission of a crime, the duty of the crime investigators is to collect and preserve evidence. They are expected to prevent its contamination, alteration, manipulation, or destruction.<sup>41</sup> This evidence is subjected to laboratory analysis with advanced equipment and technology. Following a careful analysis, the actions and decisions that took place at the crime scene and their interaction with trace materials found at the crime scene will have an impact on the questions asked, the inferences made from the result of the

---

<sup>32</sup> Forensic medicine is the application of medicine and medical science to legal problems such as the cause and circumstances in cases of questioned death; matters having to do with insurance claims, and sometimes in cases of medical malpractice.

<sup>33</sup> Odontology is the application of dentistry to human identification problems. Forensic odontologists are dentists who specialize in the identification of persons based on their dentition, usually in cases of mass disasters or otherwise unrecognizable bodies.

<sup>34</sup> Forensic anthropology has to do with personal identification based on bodily (particularly skeletal) remains; include establishing data base on bodily structures as functions of sex, age, race, stature, interpretation of footprint or shoe-print evidence etc.

<sup>35</sup> Forensic toxicology has to do with the determination of toxic substances in human tissues and organs. Largely, this investigates the role of toxic agents' cases of death.

<sup>36</sup> Questioned documents examination involves comparisons and interpretation of handwriting, as well as typed, printed and photocopied material; analysis of papers, inks, and other materials used to produce documents etc.

<sup>37</sup> Firearm and tool mark examination has to do with firearm identification, comparison of markings on bullets and other projectiles, cartridge cases, and shell cases, especially for the purpose of determining that a bullet may have been fired from a particular weapon. Tool mark examinations are concerned with the association of particular impressions with particular tools.

<sup>38</sup> A. Akinade, *op cit*,

<sup>39</sup> F. Althobathi, *op cit*.

<sup>40</sup> N. K. Gupta, S. Bhadauria, 'Role of Forensic Science in Criminal Investigation' (2024) (6) (2) *International Journal for Multidisciplinary Research*.

<sup>41</sup> *ibid*.

analysis, and the conclusion reached and how those conclusions are presented as admissible evidence.<sup>42</sup>

DNA testing can link victims and perpetrators at the crime scenes, while toxicology testing can detect the presence of drugs or toxins in the body.<sup>43</sup> Likewise, fingerprint examination can make a connection between the suspect and the crime scene or item found there.<sup>44</sup> Forensic experts reconstruct the crime scene by combining evidence, investigations and scientific analysis, giving room for the police to deduce the manner in which the crime was committed, the role of the persons involved and possible targets, thus making inferences to what transpired at the crime scene.<sup>45</sup>

Consequently, every piece of evidence obtained and linkage derived in the investigation are given as expert evidence or testimony in court by forensic experts. These forensic experts provide honest and informed opinions, bridging the gap between complex criminal investigations and the inclination of those who should be criminally responsible in the criminal justice administration.<sup>46</sup> Where forensic evidence do not link an accused with the victim or to the crime scene, the accused innocence is established and cannot be criminally responsible for the crime.<sup>47</sup> The whole essence of forensic science is to transform trace analyses, objects, fluids and relevant materials found at the crime scene into useful evidence. These are used to explain criminal hypothesis, and tested to explain observed findings with the goal of increasing the efficiency and reliability of the criminal justice administration.<sup>48</sup>

In the case of *Kunle Shonubi v. People of Lagos*,<sup>49</sup> blood samples were taken from nine suspects, it was only the appellant's own that matched. The fingernails clippings of the deceased had the

---

<sup>42</sup> R.M. Morgan, 'Conceptualizing Forensic Science and Forensic Reconstruction. Part I: A Conceptual Model' (2017) (57) (6) *Science and Justice*, 455-459.

<sup>43</sup> *Ibid.*

<sup>44</sup> *ibid.*

<sup>45</sup> A. Morgan and P. Jorna, 'Impact of Ballistic Evidence on Criminal Investigations' (2018) *Trends and Issues in Crime and Criminal Justice*, 5.

<sup>46</sup> R. M. Morgan, 'Conceptualizing Forensic Science and Forensic Reconstruction. Part I: A Conceptual Model (2017) (57) *Science and Justice*, 455-459.

<sup>47</sup> O. M. Atoyebi, The Role of Forensic Science in Criminal Investigations and Admissibility of Forensic Evidence in Nigerian Courts (2024) <https://omaplex.com.ng/the-role-of-forensic-science-and-criminal-investigations-and-admissibility-of-forensic-evidence-in-nigerian-courts/> (accessed 10 February, 2025).

<sup>48</sup> C. H Rodrigues, *op cit.*

<sup>49</sup> (2015) LPELR-24807 (CA).

DNA of the appellant. It was on record that the appellant's shirt, CCTV, DNA of deceased, finger nail clippings were sent from the Nigerian Police to London Forensic Homicide Service (Metropolitan Police) because equipment for analysis were not available in Nigeria.<sup>50</sup> The forensic reports indict the appellant beyond reasonable doubt and his appeal was dismissed. It is not necessary for a forensic expert who carried out laboratory analysis and issued the exhibit sought to be relied upon in court to be physically present in court. The document if properly tendered in the form and by the person it should be produced can be admissible.<sup>51</sup> What is important is that the forensic report is interpreted and tendered by an expert in court in the form or manner it would be admissible.<sup>52</sup>

The importance of analyzing traces of evidence no matter how inconsequential they may seem cannot be overemphasized. In *Uchechi Orisa v. State*<sup>53</sup> the appellant and two other accused persons were arrested and charged with armed robbery. The arrest was effected because one of the accused persons had fresh wound which was suspected to have been caused when he scaled the fence to escape leaving bloodstains on the fence. According to the court, tracing the bloodstain to the accused without forensic evidence backing it up would amount to mere speculation which no court can act upon. Accordingly, the supreme court went ahead to discharge and acquit the appellant.

The relevance of biotechnology in forensic science is premised on the fact that biotechnology activity has led to the discovery of structure of the hereditary material called DNA which contains all the information that dictates an individual's life. Forensic biotechnology utilizes genetic fingerprinting and DNA profiling in criminal investigations. While human genomes are 99.9% identical, unique variations exist among individuals.<sup>54</sup> Genetic fingerprinting identifies these differences through Short Tandem Repeats (STRs), which vary in number and length among people.<sup>55</sup> Using polymerase chain reaction, STRs are amplified and analyzed, typically focusing

---

<sup>50</sup> *Supra* at page 34.

<sup>51</sup> *Blessing v FRN* (2012) LPELR-9838 (CA).

<sup>52</sup> See *Kunle Shonubi v. People of Lagos (supra)* where the court discountenanced the appellant's argument that the forensic evidence amounted to 'documentary hearsay evidence' because it was not tendered by the maker. See also *Mohammed v State* (2022) LPELR-57348 (SC).

<sup>53</sup> (2018) LPELR-43896 (SC)

<sup>54</sup> S. Sharman, *Forensics and DNA: How Genetics can Help Solve Crimes* (2021) [www.hudsonalpha.org](http://www.hudsonalpha.org) (accessed 18 February 2025).

<sup>55</sup> *Ibid.*

on at least 20 STRs.<sup>56</sup> If the profiles from a crime scene and suspects match all 20 STRs, a statistical calculation estimates the rarity of such a match, with the likelihood of two individuals having identical profiles being extremely low. DNA profiles are stored in the Combined DNA Index System (CODIS), allowing law enforcement to compare evidence from crime scenes with existing profiles, potentially linking suspects to crimes.

The development of DNA analysis techniques has made it possible to identify individuals with a high degree of accuracy.<sup>57</sup> Unresolved cases have often been re-examined using DNA technology. One example is that of a suspected serial rapist in Stockholm (Laser Man) who was not indicted for ten sexual assaults in the 1980s. Fourteen years later, the samples from 1991 were analyzed and the DNA typing process was initiated.<sup>58</sup>

Advancement in DNA sequence technology in biotechnology has enhanced detection of individuals who commit a crime from genetic materials left on the crime scene which has led to a surge in both convictions and exoneration for many crimes.<sup>59</sup> DNA testing has been held to be more definitive in linking an accused to a crime than any other forensic approach.<sup>60</sup> It is also instrumental in identifying paternity, victims of crime, disasters, and war. Skin cells, blood, hair follicles, and saliva all contain DNA that can be used to identify an individual.<sup>61</sup>

## **5 Legal Framework for Forensic Biotechnology in Nigeria**

Forensic science has over the years proved to be a point of intersection of science, law, policy and their integrated practical application.<sup>62</sup> An integration of scientific principles and analytical processes helps to solve crimes, by proving guilt or innocence.<sup>63</sup> From criminal investigation to

---

<sup>56</sup> *Ibid.*

<sup>57</sup> S Lartey, 'Exploring the Impact of Forensic Science on Criminal Investigations and the Justice System: An Introduction to Africa' 7. [https://www.researchgate.net/publication/384119778\\_Exploring\\_the\\_impact\\_of\\_forensic\\_science\\_on\\_criminal\\_investigations\\_and\\_the\\_justice\\_system\\_An\\_introduction\\_to\\_Africa](https://www.researchgate.net/publication/384119778_Exploring_the_impact_of_forensic_science_on_criminal_investigations_and_the_justice_system_An_introduction_to_Africa) (accessed 6 March 2025).

<sup>58</sup> *Ibid.*

<sup>59</sup> S. Sharman, *op cit.*

<sup>60</sup> J. D. Gabel, 'Realizing Reliability in Forensic Science from the Ground Up' (2014) (104) (2) *The Journal of Criminal Law and Criminology*, 283-352.

<sup>61</sup> S Sharman, *op cit.*

<sup>62</sup> R.M. Morgan, *op cit.*

<sup>63</sup> N.K Gupta, and others, *op cit.*

presenting expert evidence, forensic science plays a strong role in promoting the rule of law and upholding justice in the criminal justice administration.<sup>64</sup>

In the midst of its pluralistic legal structure, Nigeria has no specific enactment regulating the application and enforcement of forensic science. Even though existing laws relating to forensic science like the Evidence Act,<sup>65</sup> the Cyber Crimes (Prohibition, Prevention, etc.) Act,<sup>66</sup> the Nigerian Police Act 2020 and the Administration of Criminal Justice Act (ACJA) 2015 are passive in their application of forensic science in adducing evidence, their provisions will be examined.

### **5.1 Evidence Act**

By the provisions of the Nigerian Evidence Act, computer generated evidence are admissible.<sup>67</sup> The Act stipulates that where proper foundation is laid regarding the reliability of such evidence which is relevant to the case at hand, they are admissible.<sup>68</sup> Even though the Act does not have explicit provisions regulating biotechnology and forensic science in any of its sections, electronic generated evidence such as phone records, computer files, emails, digital photographs, ATM transactions, databases, Global Positioning (GPS) tracks etc could be read into it.<sup>69</sup> Section 84 of the Act can be interpreted to include forensic evidence that are laboratory based such as nuclear and mitochondrial DNA analysis, drug analysis, fingerprints analysis, tool mark identification among others. The interpretation section of the amended Act has been expanded and enlarged incorporating definition of electronic record, audio visual communication, cloud computing, magnetic media all of which are relevant to the understanding of biotechnology and forensic science.<sup>70</sup>

The Evidence Act allows the admissibility of forensic biotechnological evidence in line with international best practices. Public servants employed in a forensic science laboratory may be

---

<sup>64</sup> *Ibid.*

<sup>65</sup> Evidence Act No 18 of 2011 as amended in 2023.

<sup>66</sup> The Cyber Crimes (Prohibition, Prevention, etc.) Act 2015 as amended in 2024.

<sup>67</sup> See sections 84, and 84A-B Evidence (Amendment) Act 2023.

<sup>68</sup> See sections 84 (2) and 84B Evidence (Amendment) Act 2023.

<sup>69</sup> G. Obamanu. 'Legal Issues and Challenges in the Admissibility of Digital Forensic Evidence in Courts in Nigeria' (2023) (8) (1) *African Journal of International Energy and Environmental Law*, 96-109.

<sup>70</sup> See section 258 Evidence (Amendment) Act 2023.

summoned to court to give expert evidence.<sup>71</sup> When a court has to form an opinion on ‘a point of law’ or ‘science,’ or ‘the identity of handwriting or finger impressions,’ the opinion of experts skilled in such matters are admissible.<sup>72</sup> In addition, computer generated documents (inclusive of forensic biotechnological evidence) are admissible subject to the limitations under the Act.

## **5.2 The Cyber Crimes (Prohibition, Prevention, etc.) Act<sup>73</sup>**

The Cybercrimes Act makes provisions for the use of forensic science in cybercrime investigations and the admission of computer-generated evidence in court. The Act primary regulates crimes related to cyber-stalking, cybersquatting, computer-related fraud and forgery, cyber terrorism, transmitting grossly offensive, indecent, obscene, or menacing messages and pictures, knowingly sending false information, promoting or inciting hatred, discrimination, or violence through the web or social media. The Act places a duty on a service provider to preserve, retain and protect data and computer-based information such as traffic data, subscriber information, non-content information, and content data as may be required by a law enforcement agency.<sup>74</sup> These service providers with the responsibility of releasing electronic communication or information to the law enforcement agency upon an order of a court of a competent jurisdiction or for legitimate reasons which would include a criminal investigation.<sup>75</sup> The law enforcement agency uses such information for the identification, tracking and tracing of proceeds of any offence or any property, equipment or device used in the commission of any crime.<sup>76</sup> The Judge may on the basis of information on oath, order a service provider, to intercept, collect, record, permit or assist competent or law enforcement officers with the collection or recording of content data and/or traffic data associated with specified communications transmitted by means of a computer system.<sup>77</sup> The Cybercrimes Act empowers the office of the National Security Adviser to coordinate all security and enforcement agencies and provide support and intelligence where necessary. It also ensures formulation and effective implementation of a comprehensive cyber security strategy and a national cyber security policy for Nigeria. The National Security Adviser is saddled with

---

<sup>71</sup> Section 55 (4) Evidence Act.

<sup>72</sup> Section 68 Evidence Act

<sup>73</sup> The Cyber Crimes (Prohibition, Prevention, etc.) Act 2015 as amended in 2024 by the Cybercrimes (Prohibition, Prevention etc) Amendment Act 2024.

<sup>74</sup> Section 38 (1-5) Cybercrimes (Prohibition, Prevention etc) Amendment Act 2024.

<sup>75</sup> Section 39 *ibid.*

<sup>76</sup> Section 40 (2b) *ibid.*

<sup>77</sup> Section 39 *ibid.*

the responsibility of establishing and maintaining the National Computer Emergency Response Team (CERT) Coordination Center responsible for managing cyber incidences in Nigeria. They are also to establish and maintain a National Computer Forensic Laboratory and coordinate utilization of the facility by all law enforcement, security and intelligence agencies.<sup>78</sup> The National Computer Emergency Response Team (CERT) is responsible for the administration of forensic laboratories for the purpose of crime prevention, combat and investigation.<sup>79</sup>

### **5.3 The Administration of Criminal Justice Act (ACJA) 2015**

The Administration of Criminal Justice Act did not make any direct provision regarding the administration of forensic scientific mode of criminal investigation. However, it recognizes its use as it provides that upon arrest of a suspect, his personal records inclusive of full fingerprint impressions should be taken and recorded in the prescribed form.<sup>80</sup> Similar procedure is also adopted in documenting and keeping detailed information of convicts sentenced to community service.<sup>81</sup> Additionally, in requesting for the remand of a defendant, the prosecuting officer is required to state particulars of other evidence linking the defendant the offence. This other evidence includes forensic evidence, marks, finger prints among others.<sup>82</sup> The Administration of Criminal Justice Act allows expert opinion or evidence during trial.<sup>83</sup> It also supports giving both parties a fair opportunity at trial in court. Where sufficient evidence (including forensic) is not adduced in linking the accused with the commission of crime with which he is charged, the court will uphold a no case submission.<sup>84</sup>

As indicated earlier, even though ACJA has no explicit provision on biotechnology or forensics, some of its provisions underscores expert opinions and scientific investigations. Generally, procedures that ensures fair trial and speedy dispensation of justice inclusive of forensic science can be read into it.

---

<sup>78</sup> Section 41 *ibid.*

<sup>79</sup> Section 41 *ibid.*

<sup>80</sup> Section 15 (1) Administration of Criminal Justice Act (ACJA) 2015.

<sup>81</sup> Section 461 (3) (a) ACJA.

<sup>82</sup> See Form 8, First Schedule of the Act. See also section 293 ACJA.

<sup>83</sup> See sections 326 and 232 ACJA

<sup>84</sup> See sections 302 and 303 ACJA.

#### 5.4 The Nigeria Police Act, 2020

The Nigeria Police Act provides the regulatory framework for police operations in Nigeria. The Act grants to the police extensive powers in crime detection, prevention and investigation.<sup>85</sup> It is important to state that the use of forensic science in crime detection, prevention and investigation is not stated explicitly in the Act. The periodic training and re-training of police officers in crime detection, investigation and law enforcement contemplated under the Act did not include such training in forensic science.<sup>86</sup> However, the provisions of the Act reveal passive recognition of the need to engage forensic methodology in criminal administration. Under the Act, a police officer shall take record for the purpose of identifying persons in its lawful custody. These records shall include photographs, finger prints impression and all other means of identification.<sup>87</sup> The Act also stipulates that records pertaining to court decisions in a criminal trail are to be kept in a Central Criminal Records Registry.<sup>88</sup> Such records could be relevant in future forensic investigation.

#### 5.5 Lagos State DNA and Forensic Centre Law

The Lagos State House of Assembly enacted a law establishing the Lagos State Deoxyribo-Nucleic Acid (DNA) and Forensic Center sometimes in 2022. The objective of the law is to support criminal investigation, law enforcement and preservation of evidence for the judiciary and other connected purposes.<sup>89</sup> The rationale for establishing the Centre was to regulate DNA-based technology, to analyze drug chemistry or toxicology, to carry out fingerprints examination, tool-mark examination, ballistics, trace evidence analysis, questioned document examination, and digital forensics, all to aid criminal investigation processes.<sup>90</sup> The law also provides for the establishment of a DNA database and a DNA index system in Lagos State for storage of reference to DNA samples and to carry out forensic test for medical purposes, evidence for justice delivery in court among others.

---

<sup>85</sup> See section 214 Constitution of Federal Republic of Nigeria, 1999 (as amended).

<sup>86</sup> Section 19 of the Nigeria Police Act 2020.

<sup>87</sup> Section 44, Section 68 of the Nigeria Police Act 2020.

<sup>88</sup> Section 67 of the Nigeria Police Act 2020.

<sup>89</sup> Premium Times News, 'Lagos Assembly Passes Bill on DNA, Forensic Centre' *Premium Times* (September 5, 2022) <https://www.premiumtimesng.com/news/top-news/552457-just-in-lagos-assembly-passes-bill-on-dna-forensic-centre.html?tztc=1> (accessed 6 March 2025).

<sup>90</sup> *Ibid.*

Despite having a weak legislative framework, in practice, the Nigeria Police have adopted the use of forensic scientific method in criminal investigation more particularly in cyber-crimes and financial crimes where forensic audits are carried out. However, in crimes involving murder, assault, rape, robbery, terrorism and insurgent activities the use of forensic method in its criminal investigation is poor hence the need for proactive measures to curb the menace of crime in Nigeria.<sup>91</sup>

## **6 Forensic Biotechnology in the United States of America (USA)**

Traditionally, forensic science has been used primarily in the administration of criminal justice process for the purpose of investigation which seeks to identify the likely perpetrator of a crime, and prosecution, which seeks to prove the guilt of a defendant beyond a reasonable doubt.<sup>92</sup> In the United States, forensic sciences have evolved and progressed due to advancements in knowledge and technology and continued efforts to strengthen standardization and accreditation through its criminal justice system.<sup>93</sup> The American criminal justice system is complex with its multiple laws and policies regulating forensic science. These regulations emanate from several bodies- federal government agencies, states commission and professional forensic experts. However, the Office of Justice Program, a component of the U.S. Department of Justice (DOJ) through the National Institute of Justice (NIJ)<sup>94</sup> is responsible for coordinating the advancement of scientific research, development, and evaluation to enhance the administration of justice and public safety. The coordination by DOJ became necessary because forensic evidence is largely used by the courts in justice administration than any other field.<sup>95</sup> The DOJ ensures that criminal prosecutions are not only fair in their process but correct in their outcome. This they do by ensuring that testimony about forensic evidence presented in court is scientifically valid.<sup>96</sup>

---

<sup>91</sup> Z. M Sarki, G. A Mat Saat, 'Nigeria Police and Forensic Criminal investigations: A Review of some Critical Issues' (2020) (15) (1) *International Journal of Criminal Justice Sciences*.

<sup>92</sup> The U.S. Department of Justice, Office of Justice Programs.

'Needs Assessment of Forensic Laboratories and Medical Examiner/Coroner Offices: A Report to Congress' <https://www.ojp.gov/ncjrs/virtual-library/abstracts/needs-assessment-forensic-laboratories-and-medical-examiner-coroner> (accessed 7 March 2025).

<sup>93</sup> *Ibid.*

<sup>94</sup> The National Institute of Justice is a component of the Office of Justice Programs, which also includes the Bureau of Justice Assistance; the Bureau of Justice Statistics; the Office for Victims of Crime; the Office of Juvenile Justice and Delinquency Prevention; and the Office of Sex Offender Sentencing, Monitoring, Apprehending, Registering, and Tracking.

<sup>95</sup> S. A. Cole, 'Who Will Regulate American Forensic Science?' (2018) (48) *Seton Hall Law Review*, 563.

<sup>96</sup> *Ibid.*

Generally, the Federal Rules of Evidence govern admissibility of forensic evidence in the USA. To be admissible, the evidence has to meet certain criteria like sufficiency of facts, relevance and reliability.<sup>97</sup> Experts are allowed to base their opinions on facts or data in the case the expert has been made aware of or personally observed by them.<sup>98</sup> The DNA Identification Act of 1994 established the creation of the combined DNA Index System (CODIS). The Act which is administered by the Federal Bureau of Investigation (FBI) stipulates guidelines for DNA sampling and the inclusion of profiles in federal databases. The DNA Fingerprinting Act of 2005 expanded the CODIS database and increased funding for DNA analysis. The Justice for All Act of 2004<sup>99</sup> make provisions to enhance the criminal justice process, protect crime victims' rights.<sup>100</sup> The Act expanded the DNA testing capacity of crime laboratories<sup>101</sup> and eliminates the substantial backlog of DNA samples collected from crime scenes and convicted offenders.<sup>102</sup>

In *Daubert v. Merrell Dow Pharmaceuticals*,<sup>103</sup> petitioners (two minor children) and their parents alleged that the serious birth defects of the children had been caused by the prenatal ingestion of a drug marketed by the respondent. In determining admissibility of scientific evidence, the supreme court held that the Federal Rules of Evidence suspended the much older Frye's standard.<sup>104</sup> The courts are accused of not rigorously applying rule in *Daubert* now codified as Rule 702, this because judges lack understanding of the factors and of scientific reliability in general.<sup>105</sup> Critics have also argued that many forensic disciplines like bite mark analysis and hair comparison have slipped past *Daubert* scrutiny. Nevertheless, federal courts and about 40 states have adopted the *Daubert* standard in determining the admissibility of forensic evidence.

---

<sup>97</sup> See Rule 702 FRE.

<sup>98</sup> Rule 703, FRE. See also the case of *Daubert v. Merrell Dow Pharmaceuticals* 509 U.S. 579 (1993) where the supreme court established standards for evaluating the evidence of an expert which includes testable hypothesis, known/potential error rate, peer review and other factors.

<sup>99</sup> (H.R. 5107, Public Law 108-405)

<sup>100</sup> Section 102

<sup>101</sup> Section 203

<sup>102</sup> Section 206, 311

<sup>103</sup> 509 U.S. 579 (1993)

<sup>104</sup> See *Frye v. United States* 293 F. 1013 (D.C. Cir. 1923) where the court held that expert testimony must be based on scientific methods that are sufficiently established and accepted.

<sup>105</sup> S. Gordon, 'Old Habits Die Hard: Precedent, Psychology, and the Admissibility of Forensic Evidence' (2025) *University of Toronto Law Journal*, 13.

The court in *Melendez-Diaz v. Massachusetts*<sup>106</sup> held that forensic reports are ‘testimonials’ and their analysts must testify in person if requested. According to the ruling, opportunity must be presented for the defense to cross examine the analyst who prepared the forensic report. However, the ‘notice-and-demand’ practice of putting defense on notice that prosecution would present forensic report without the analyst or scientist giving evidence in court is held to be constitutional. The defendant can raise objection to this procedure if he so wishes.

Several agencies are responsible for regulating laws and policies on forensic biotechnology in the USA. These specialized agencies observe the development, validation, and implementation of forensic and biotechnological procedures in the United States. The Federal Bureau of Investigation (FBI) set standards for DNA analysis and profiling, operates the Combined DNA Index System (CODIS) and enact guidelines for quality control and assurance, respond to incidents, collect evidences and crime scene documentation, carry out forensic analyses, and provide expert witness testimony.<sup>107</sup> The Organization of Scientific Area Committees (OSAC) coordinates, reviews and evaluate standards and guidelines developed by developing organizations for inclusion on the OSAC Registries of Standards and Guidelines.<sup>108</sup> Also, the President’s Council of Advisors on Science and Technology (PCAST) which is an advisory group of leading scientists and engineers in America, makes policy recommendations and augment the advice available from other federal agencies.<sup>109</sup> The National Institute of Justice (NIJ) coordinates all stakeholders and agencies involved in forensic sciences. The institute funds research and sets standards for forensic science laboratories. In improving its forensic analysis protocol, in September 2024 the institute announced \$1.1 million funding in support of three new projects and \$16-million funding to support 33 projects in 2023.<sup>110</sup>

Even though the legal framework in the USA for forensic science is decentralized and multi-layered, the collaborative efforts of the courts, investigators, laboratory personnel, and other

---

<sup>106</sup> 557 U.S. 305 (2009)

<sup>107</sup> *Ibid.*

<sup>108</sup> *Ibid.*

<sup>109</sup> Executive Office of the President President’s Council of Advisors on Science and Technology (PCAST), Report to the President Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods (2016).

<sup>110</sup> N. Martynenko. ‘Methodological Support for Forensic Science in the USA and Ukraine: A Comparative Study’ (2025) (10) *Forensic Science International: Synergy*, 7. See also *NIJ announces \$1.1M to Fund Research in Public Forensic Laboratories in 2024* <https://nij.ojp.gov/funding/nij-announces-11m-fund-research-public-forensic-laboratories-2024> (accessed 13 May 2025).

stakeholders have enhanced the criminal justice system. Significant reforms have been recorded in modernizing regulatory framework and bolstering national security.

## **7 Conclusion and Recommendation**

Over the years, forensic science and biotechnology have evolved to become one of the most reliable forensic techniques adopted in identifying a criminal. The instrument of the law for regulation is necessary for proper coordination, authenticity and validity of forensic results. To ensure the reliability of forensic evidence, the underlisted are recommended:

- a.) Law Reform and Establishment of Autonomous Agency:** The foundation of every civilized society is its enacted laws, whose primary goal is to regulate and organize the state, empower and establish institutions and structures that will work for public good. Unfortunately, in Nigeria there are no specific laws regulating biotechnology and forensic science. Nigerian legislature must take the lead in establishing workable structures through the enactment of specific laws that would enhance efficient and reliable criminal justice administration. In addition, Nigeria needs an autonomous federal agency (different from the police and every other law enforcement agency), that would be devoted to the reliable development of forensic science in Nigeria. Such agency will promote research and training of independent forensic scientist with specialties in various forensic divisions so as to give room for specialization and development. The essence of this autonomy is to avoid undue influence from other stakeholders. Their expert opinion should be untainted, authentic and reliable for courtroom advocacy. The replication of this forensic agency at the state level will enhance cooperation and collaborative efforts to sanitize the justice system at all levels.
- b.) Training of Forensic Experts:** The need for the training of law enforcement officers in forensic science and the employment of technology in criminal investigation and prosecution in Nigeria is long overdue. An academy or institution can be established for that purpose, in collaboration with universities and research institutions that would enhance speed in research, development and application of forensic science in Nigeria. Forensic Expatriates Scientist can be employed to carry out this training to a large number of these officers instead of taking a few of them abroad for training. The need to improve in skills

and knowledge of criminal administration cannot be ignored as criminality in itself has evolved and it only take officers who are armed in these skills and knowledge to carry out seamless investigation and secure impartial conviction.

c.) **Central Criminal Database:** Nigeria do not have a central criminal data base. The importance of a central database of Nigerians accessible by law enforcement agents cannot be overemphasized. Data collated by telecommunication companies, the central bank, the National Identification Commission, medical institutions and several others all serve as sources of data that can be harnessed for criminal investigation and forensic analysis. It is recommended that the National Population Commission should create a central database that will be relevant and useful in the criminal justice administration. This database can be useful for different other sectors of the economy. By adopting a central criminal database, the effective operation of forensics will be enhanced where comparison with certain data (such as DNA, fingerprints, facial recognition) is required.